EVIDENCE OF AN EUSTATIC STRAND-LINE MOVEMENT OF 100 TO 150 FEET ON THE COAST OF NEW SOUTH WALES.

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(Four Text-figures and one Map.)

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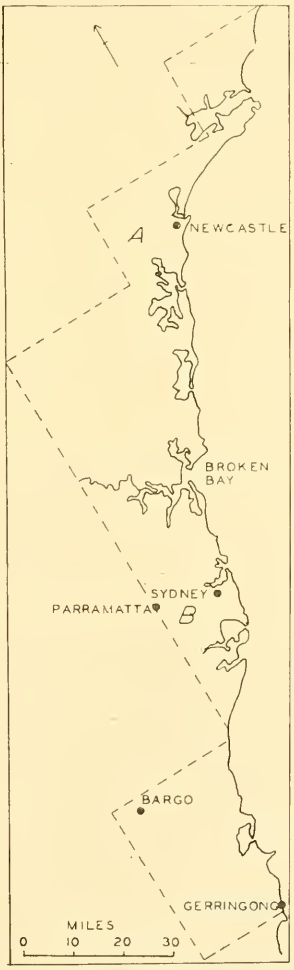
Evidence of eustatic strand-line movements have been established in many parts of the world. In New South Wales, a level about 20 feet above the present sea-level which may have an eustatic origin has been noted by many writers—David (1907), Hedley (1924), Maze (1933), Voisey (1934), and Jutson (1939), etc. Only a few records—



Map 1.—The central coastal area of New South Wales. The area for which the altimetric frequency curve in Fig. 1 was constructed is enclosed by the dashed line. The altimetric frequency curves in Figs. 2 and 3 are for the areas marked A and B respectively.

Browne (1926), Voisey (1934) and Sussmilch (1940)—have been made of silt terraces and gravels along the coastal rivers at elevations of 100 to 150 feet higher than the present river levels. Field observations and analysis of topographic maps reveal that this higher level has a wide distribution.

Evidence from Altimetric Frequency Curves.

The introduction and use of altimetric frequency curves for land-form analysis has already been discussed (Maze, 1944). It consists of the statistical analysis of spot heights or the heights deduced from the contours of the highest points in uniform squares on topographic maps.

The one inch to a mile topographic maps for the central coastal area of New South Wales, as defined in Map 1, have been examined and the values of the heights in each of the 1,000 yards grid squares have been listed and arranged so as to give the frequency of occurrence of each height. From these frequencies a frequency curve has been constructed (Fig. 1) to show the altitudinal distribution of the "high points" over the

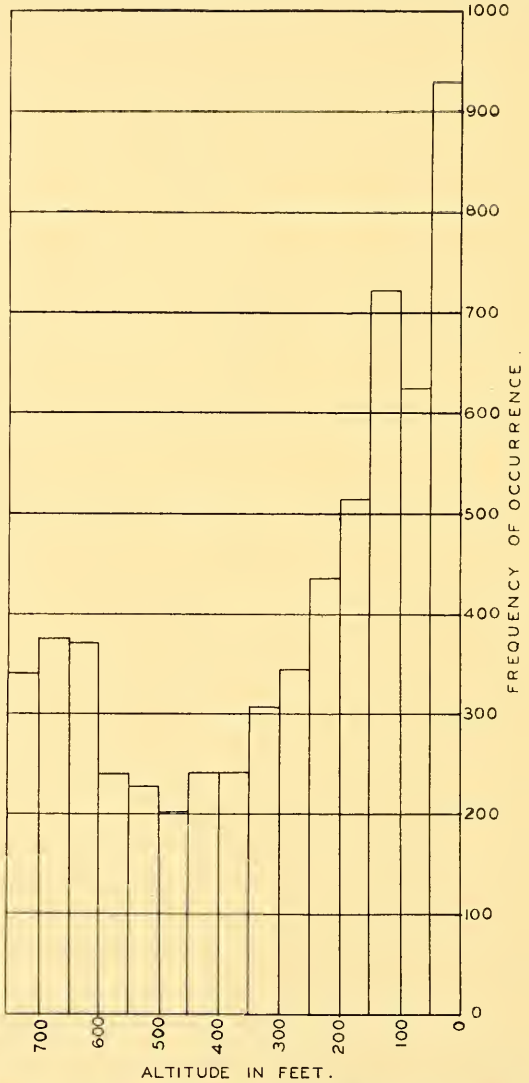


Fig. 1.—Altimetric frequency curve for the central coastal area of New South Wales.

area. On an altimetric frequency curve a well-marked frequency maximum indicates the presence of a fairly level bench or platform. In Fig. 1, a maximum occurs for the elevations between 0 and 50 feet. This indicates the widespread areas, mainly consisting of depositions which have been partly exposed by the recent small negative movement of sea-level. [See David (1907) and Maze (1933), etc.] The frequency curve drops for elevations between 50 and 100 feet and then rises abruptly for elevations between 100 and 150 feet. There is thus over the whole central coastal area of New South Wales a greater frequency of elevations between 100 and 150 feet than any other elevation except those between 0 and 50 feet.

The altimetric frequency evidence is even more striking when smaller areas are considered in more detail. Fig. 2 is an altimetric frequency curve for area A as shown in Map 1. This area extends along the southern side of the Hunter River from Newcastle

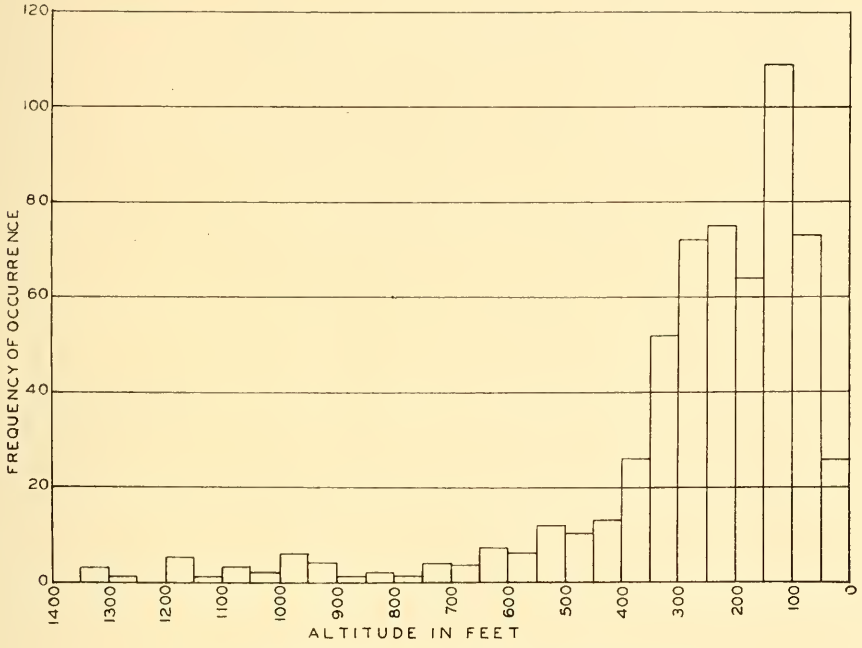


Fig. 2.—Altimetric frequency curve for the Newcastle district, or area marked A on Map 1.

to East Maitland and south to Lake Macquarie. All the low-lying depositional landforms (less than 25 feet above sea-level) such as swamplands and recent sand deposits have been omitted in the analysis of the heights, so that Fig. 2 is an altimetric frequency curve of an erosional surface. In it the maximum frequency for elevations between 100 and 150 feet is even more apparent. This is amply borne out by field-survey, which reveals that gently sloping spurs and benches between these elevations are a characteristic feature of the area.

Fig. 3 is an altimetric frequency curve for area B, or the Sydney district, as shown on Map 1. This curve also shows the frequencies rising to a maximum for the elevations between 100 and 150 feet.

The altimetric frequency curves thus point to the widespread existence of a bench along the coast at an elevation between 100 and 150 feet.

Evidence from Valley-in-Valley and Longitudinal River Profiles.

Evidence of valley-in-valley forms is common in the Sydney district, particularly in the tributaries of Middle Harbour. Fig. 4, which was constructed from field-survey observations, illustrates the longitudinal profile and two cross-sections of Flat Rock

Creek, a tributary of Middle Harbour. The longitudinal profiles of the main stream and its tributary both have well-marked knickpoints, and the cross-sections show well-defined valley-in-valley forms. Many pitfalls and assumptions attend any attempts at extrapolation and reconstruction of cross-sections [see Johnson (1938) and Miller (1939)]. In the case of Flat Rock Creek the extrapolation and reconstruction required are only for a relatively short distance and a valley-in-valley section is available for the

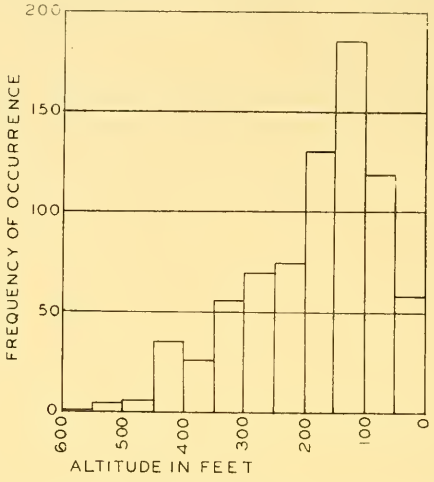


Fig. 3.—Altimetric frequency curve for the Sydney district, or area marked B on Map 1.

lower reaches of the Creek (Section B). If the reconstructed valley-floor heights of 160 feet from Section A and 140 feet from Section B are used, then the dashed line in Section C is an attempt to reconstruct the pre-rejuvenation profile of the stream. This would suggest a former base-level or sea-level at an elevation of 100 to 150 feet higher than at present.

The necessity for detailed field-survey to obtain the precise data for stream profile reconstruction makes it impossible, for the time being, to attempt this work on a large scale. Aneroid observations and the use of the 1 inch to 1 mile topographic map reveal that Moore's Creek, another tributary of Middle Harbour, has a well-defined knickpoint and valley-in-valley forms of the same order as Flat Rock Creek. Similarly on the eastern side of Lane Cove River, Sydney, in the vicinity of Bradfield, there is an extensive bench in the valley side about 150 feet above sea-level.

Observations to date do not reveal similar knickpoints in many of the coastal streams of New South Wales, but in the Hunter Valley, valley-in-valley forms are confirmed by the wide distribution of terrace and river gravels from Newcastle up to Scone. At East Maitland there is a marked bench (Sussmilch, 1940) covered with river sands and gravels about 125 feet above the present river level. Browne (1926) has also described relics of former flood-plains, which are found up to a maximum elevation of 120 feet above the river level at Gosforth. Similar river gravels occur on terraces above the Hunter River near Muswellbrook and west of Kingdon Ponds near the town of Scone.

On the Macleay River, Voisey (1934) has also described gravels, 100 feet and more above the present river level.

Conclusion.

Evidence from field observations and from a large-scale statistical analysis of the topographic maps indicates a wide distribution of a level of deposition and erosion along the central coastal area of New South Wales at a level between 100 and 150 feet above sea-level. The existence of such a surface can best be explained by postulating a period of prolonged stability of sea-level corresponding to a maximum of transgression at about 150 feet. It would also appear from the evidence of the valley-in-valley forms that the

time which has elapsed since the withdrawal of the sea and subsequent rejuvenation of the valleys has been small compared with that taken for the earlier broad valleys to be graded to the higher base level.

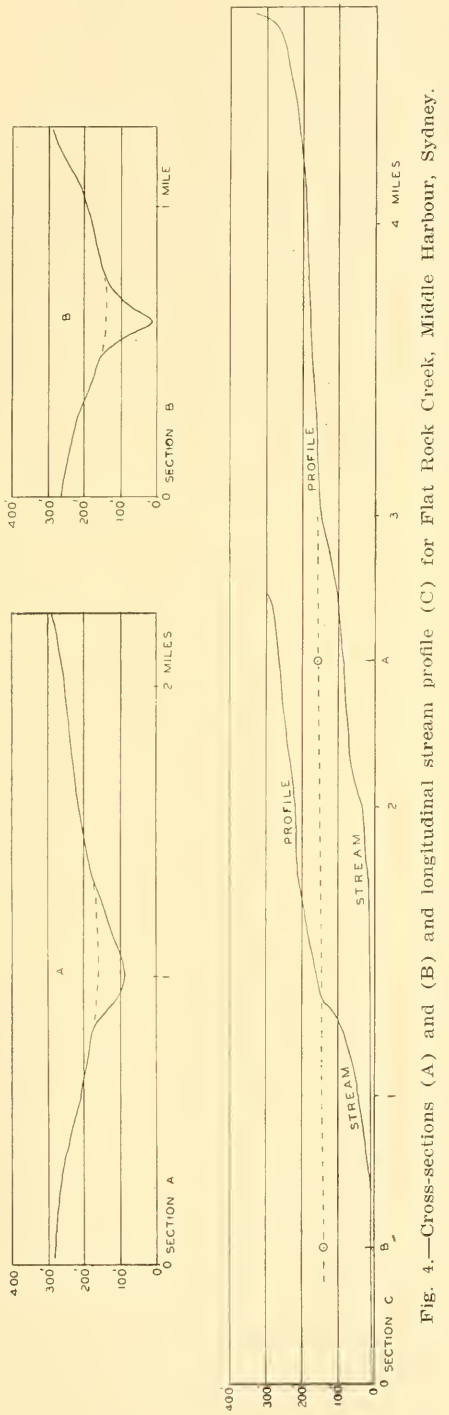


Fig. 4.—Cross-sections (A) and (B) and longitudinal stream profile (C) for Flat Rock Creek, Middle Harbour, Sydney.

Further detailed work is required to see if a range of terraces exists such as are described for the Mediterranean and Atlantic coasts. The 100- to 150-feet level for New South Wales may be correlated with the Tyrrhenian (30–35 metres) terrace of the Mediterranean, the 100-feet beach of Britain or the 30-metre terrace of eastern North America. The latter terraces have been attributed to Pleistocene strand-lines formed by oscillations of the sea-level during the inter-glacial stages.

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